technically incompetent, but because they have had a run in or just never developed a good relationship with their superiors.

I recommend this book to everyone. I suggest that you purchase a copy and throw it into your travel suitcase. Then, the next assignment that takes you away from the plant and gives you some time alone in the evening, turn off the TV and pull out the book. The chances are very good that you will be glad you did.

A couple of things will happen to you as you read this book: 1) You will probably become very agitated. As you read about how you could be doing things to cement your relationship with the boss, you will probably tell yourself you have been doing them 180 degrees out. 2) You will begin to see where you have made some unpleasant characteristics of your own predominant as reactions to certain relationships instead of resolving the problems of those relationships. 3) You will begin to see that a long term strategy could have helped you to be better than you are, and your immediate need for one becomes unsettling.

Mr. Vance defines boss (some feel it comes from the word "baas" which in Dutch meant overseer), tells why you have a love-hate relationship, fitting yourself into the world of business and where your boss can help you, developing winning ways with an insensitive boss, helping a responsive boss move you upwards, drawing your own map, and other topics as well.

This is one of those very "personal" books that come out from time to time and one should refer to it from time to time after an initial "deep" reading.

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Applications of Fuzzy Sets to Systems Analysis—C. B. Negoita and D. A. Ralescu (Basel, Switzerland and Stuttgart, Federal Republic of Germany: Birkhaüser Verlag, New York: Wiley–Halstead, 1975, 191 pp.). *Reviewed by Siegfried Gottwald, Department of Mathematics, Karl Marx University, 701 Leipzig, German Democratic Republic.*

The effect of vagueness has been know in the real world for a long time; but only in about 1965 was it brought into scientific considerations as the notion of fuzziness by L. A. Zadeh. The notion of fuzziness can be used to describe interesting practical situations more naturally than the usual strict mathematical approach. Therefore, the notion of fuzziness has been used in many areas of mathematics and engineering, e.g., automata theory, algorithm theory, systems science, decision-making, clustering, language theory, set theory, and logic.

In recent years many research papers on fuzzy topic have appeared in different journals, and a great variety of results have been proved. Thus it is most desirable to have a systematic treatment of these matters. The book under review fills this gap. It treats fuzzy set theory as a mathematical model for various applications in system science and related topics.

The book is well written in a very clear style. In contrast to the books of A. Kaufmann [*Théorie des Sous-Ensembled Flous: A l' Usage des Ingenieurs*, Tome 1-3, Paris, 1973-1975] it is addressed to the scientist. For him it can be very stimulating to future research.

The book is divided into the following seven chapters: 1) fuzzy sets, *L*-sets, flou sets; 2) fuzzy theories; 3) fuzzy logic; 4) fuzzy systems; 5) fuzzy automata, fuzzy languages, fuzzy algorithms; 6) deciding in a fuzzy environment; 7) fuzzy clustering. In each chapter there are historical and bibliographical remarks. Hence, the reader is provided with good information on the development of the subject and on further questions raised in the literature. The choice of material by the authors concentrates on the essential notions and results, but most of the existing papers have also been taken into consideration. In all, this is a really good book.

Reprinted from *IEEE Transactions on Systems, Man, and Cybernetics*, September 1977.

Computer-Aided Experimentation: Interfacing to Minicomputers—Jules Finkel (New York: Wiley, 1975, 422 pp.). *Reviewed by M. E. Sloan, Department of Electrical Engineering, Michigan Technological University, Houghton, MI 49931.*

Computer/Aided Experimentation is intended to familiarize engineers and scientists with the basic concepts and methods needed to use minicomputers in real-time environments. It is based on a course taught by the author to scientists and graduate students at the Weizman Institute of Science in Israel.

The book has 20 chapters, concentrating on hardware but including some software. Chapter topics include analog signals and recording, analog-to-digital conversion, amplifiers, remote sensing and computing, position encoding, interface logic design, digital inputs and outputs, input–output instructions and devices, interrupts, data channels, man-machine interactions, minicomputer architecture, programming, and CAMAC interfaces. The organization of topics may make sense to the author, but it is not clear to this reviewer. The chapter on analog signals is separated from the one on analog-to-digital conversion by a chapter on instrumentation amplifiers; then the chapter on analog-to-digital conversion is separated from the one on digital inputs by four chapters on telemetry, position encoding, analog recording, and interface logic design. Similarly, Chapter 8 discusses interface logic design, while Chapter 19 discusses CAMAC interfaces. Chapters seem to be sprinkled through the text almost at random.

The treatment is general and aimed at presenting the concepts of the operation of each device. Few examples of devices are shown, and no applications are discussed in depth, in marked contrast to the presentation of other books. Because the reader (whom the author calls "the experimenter") is assumed to know little about electronics or computers, the presentation is basic and thorough. Thus the book is best suited for scientists who want to have a basic introduction to minicomputers and interfacing before reading other books that show actual circuits complete with parts numbers and pin connections.

Finkel offers sensible advice to the novice. He points out, "The most underestimated aspect of any computer project is the programming effort" (p. 376). "The value of good systems programs is usually underestimated, especially by the novice computer user" (p. 377). For those unfamiliar with basic circuits he points out, "Insofar as the experimenter is concerned, the actual logic voltage levels are of very little import."

The book is somewhat dated. Its timing was unfortunate as it missed the significance of microcomputers, an important aspect of interfacing today, and one that could easily be treated along with interfacing to minicomputers. It also considers bipolar logic to be almost universal, a condition that is less true today than it was a few years ago. Further, the author does not use modern logic symbols.

The more advanced reader will be distressed by the paucity of references. Only periodicals and commercial literature are suggested. Readers who know something about logic circuits or who want more detail might be well advised to skip this book and instead read some of the ones listed below. The first three treat digital design needed in interfacing. The next three discuss minicomputers with some treatment of interfacing. The last three are on microcomputers with good discussions of interfacing.

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Quantum Detection and Estimation Theory—Carl W. Helstrom (New York: Academic, 1976, ix + 309 pp., $24.50). *Reviewed by Horace P. Yuen, Massachusetts Institute of Technology, Cambridge, MA 02139.*

This lucid account of quantum detection and estimation theory is the first book on the ten-year old subject, statistical theory of quantum signal detection, written by its pioneer, Professor Helstrom. The book ". . . addresses two groups of readers. The first includes communications engineers and scientists and students of communication theory who need to cope with basic problems arising in communication with optical signals. The second group of readers comprises physicists interested in the foundations and applications of quantum mechanics . . ." Since the readers of IEEE TRANSACTIONS ON INFORMATION THEORY usually fall in the first group and since the foundation questions of quantum theory are still controversial, this review is written primarily for the first group of readers.

At optical frequencies, quantum effects play a significant role in determining the performance of communication and detection systems. On the one hand, an otherwise deterministic signal at a receiver has to be replaced by a statistical quantum description. On the other hand, the qualitative and quantitative nature of the quantum noise that a receiver suffers is strongly dependent on the quantum measurement that the receiver performs on the received optical signal. In designing a receiver, one has to make a choice between the various possible but mutually exclusive quantum measurements, such as measurement of phase versus measurement of amplitude, to extract efficiently the relevant information. In a quantum detection theory, one therefore needs to develop quantum mechanical receiver models and to consider the measurement optimization problems that are additional to the conventional classical (nonquantum) theories. Helstrom's book shows how such a revision of classical detection and estimation theory may be carried out to yield the corresponding quantum detection theory.

This book can be used as a research monograph or a reference, as well as a textbook. Although the corresponding classical detection and estimation theory is reviewed in the book, the reader will probably not appreciate the nature and significance of the quantum results without further prior exposure to detection theory. However, enough quantum mechanics and motivation are included so that someone with a detection theory background can follow the quantum generalization without too much difficulty. Apart from the unfamiliar quantum notation, the mathematical level is no higher than what would be expected from such a reader. This means that the quantum formulations in the book are not cast in the most precise, rigorous, abstract, and general fashion. Rather, formal developments and techniques are emphasized for obtaining explicit results. In my opinion, this represents a strength rather than a weakness of the book. It enormously increases the circle of potential readers. For those readers with a strong mathematical orientation, most of the quantum results in this book can easily be made precise with the standard mathematical formulation of quantum theory [1].

Chapter 1, "Decision and estimation," consists of six pages introducing the nature of the problems to be treated. Chapter 2, "Classical detection and estimation theory," develops and summarizes in 32 pages those basic results in classical signal detection whose quantum correspondents are treated in the rest of the book. Chapter 3, "Quantum mechanics," (49 pages) presents the formal structure and statistical interpretation of quantum mechanics including the important concept of probability operator measure [2] needed in the quantum decision problems. Chapter 4, "Quantum hypothesis testing," (31 pages) presents the optimum quantum strategy in multiple hypotheses testing with many illustrative examples. The quantum Neyman-Pearson test and threshold detector are also developed. Chapter 5, "Quantum electromagnetism," summarizes in 41 pages the quantization of electromagnetic fields needed for applying Chapter 4 to physical signals in Chapters 6 and 7. The coherent state calculus for the radiation field is also extensively developed. Chapter 6, "Detection of coherent light," (36 pages) utilizes the results of the two preceding chapters to treat coherent detection in some detail. Physically realistic receiver structures that are optimum or suboptimum in some of these problems are also discussed. Chapter 7, "Detection of incoherent light," (39 pages) gives a detailed exposition on the quantum incoherent detection of point sources and extended objects including the necessary background on classical spatial-temporal coherence. Chapter 8, "Quantum estimation theory," (59 pages) presents a number of quantum estimators and quantum Cramér–Rao inequalities with many different examples. The three-page epilogue concludes the book. A long list of references to the literature is included with a five-page index.

The treatment is generally clear and efficient, though a few lapses do occur. For example, the conclusion is drawn in the discussion of orthogonal signals in Chapter 6 that the capacity of an optical channel is not limited by quantum effects because it is infinite in the absence of classical interference and noise. This is true provided an infinite amount of bandwidth is available. For finite bandwidth and power, one can readily show that the capacity is finite. In fact, the capacity per degree of freedom is finite. Thus one should conclude that optical capacity is indeed quantum limited, particularly since infinite bandwidth is not physically realizable.

This book covers the majority of published results in quantum detection and estimation theory. It includes significant unpublished, or yet to be published, results of Dolinar and of Kennedy. Still, the reader will find that no quantum parallels were provided for many important classical results. I hope this book will stimulate some readers to develop these missing quantum theories themselves.

The topics treated in this book are all akin to signal detection with no separate treatment of information-theoretic or transmitter design problems. This stems no doubt partly from the paucity of such quantum results in the literature, a situation which I hope will change in the future.

The quantum results developed in this book are practically significant in the sense that they show how close the performance obtained with available optical detection schemes comes to the ideal optimal performance. Similar to most classical communication and detection theory, quantum detection theory has not yet produced any revolutionary change in the practice of optical detection.

We recommend this book highly to students and research workers interested in the theoretical aspects of optical communication. It should provide enjoyable reading to all communication theorists, and will broaden their vision of the scope of communication theory.

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EMP Radiation and Protective Techniques—L. W. Ricketts, J. E. Bridges, and J. Miletta (New York: Wiley, 1976, 394 pp., $27.50). *Reviewed by Dr. Carl E. Baum, Air Force Weapons Laboratory, Kirtland AFB, NM 87117.*

Analysis of the nuclear electromagnetic pulse (EMP) is a vast and complex subject. Its disciplines include atomic and nuclear physics, electromagnetic theory, properties of electronic devices, and various functionally related system considerations. While this book treats these various aspects, it does so with varying degrees of success.

Chapter 1, which treates EMP environments, introduces some of the basic physical quantities associated with EMP generation. In the list of EMP source region quantities, the conduction plus displacement current density should have been included as it is a major driver of electric-dipole antennas with small size and small load impedance. The assertion that the source region waveforms have similar time waveforms is misleading, and is at variance with the well-known saturation phenomenon in EMP source regions in air. Another significant defect lies in the references and bibliography. The basic contributors to EMP generation phenomena, both American and British, are not represented even though their reports, conference papers, etc., are widely recognized and documented. Recognition of the contributors should be given fairly and objectively.

Chapter 2, which treates EMP interaction, is very limited as compared with the scope of the problem. Important subjects such as the currents and charges on the exteriors of missiles, aircraft, and buildings are not included. For apertures the most commonly used model is the small hole theory of Bethe; this is not discussed, but less useful models are presented. At best this chapter presents some limited exposure to selected EMP interaction topics. Major portions of the EMP interaction literature are not referenced giving a distorted view of both the state of the art and the prominent contributors.

In Chapter 3 things pick up, apparently because the authors are on more familiar ground. There is a fairly extensive and enlightening discussion of damage mechanisms in semiconductor devices. At one point the authors limit the time duration of the signals reaching the components from the external EMP environment; they neglect the important and often more determining factor associated with the damping of the system resonances in this time duration. This discussion is continued in Chapter 4 to related protective techniques and provides some good material. Noting in the shielding discussion the authors include the important inductive term which has often not been recognized. They also include both the magnetic and electric equivalent per-unit-length sources in cables; however, they neglect to cite the contributors who developed the recently recognized electric term in this context. The related laboratory test techniques are given a reasonably good qualitative discussion in Chapter 5.